DEPARTMENT OF TRANSPORTATION
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LABORATORY PROCEDURE FOR TREATING DAMP AGGREGATE WITH DRY LIME FOR ASPHALT CONCRETE MIX DESIGN

SCOPE

This protocol provides a laboratory procedure for treating damp aggregate with dry hydrated lime, with or without marination, for use in asphalt concrete mix design.

APPARATUS

1. *Balance* - Accurate to 0.1 g.

2. *Plastic Containers* – One liter with watertight lids for storing materials.

3. *Graduated cylinder* - 100 ml

4. *Small round tins* - 70 mm diameter x 48 mm deep.

5. *Oven and equipment from California Test 304* - for preparation of design set.

6. *Miscellaneous Apparatus and Tools* – Trowel or spoon, stopwatch or timer, heat resistant gloves and safety glasses or goggles.

MATERIALS

1. Aggregate - If marination is used, component (coarse and fine) aggregate shall be treated and cured separately. If marination is not used, the combined aggregate shall be treated. Coarse aggregate is material retained on the 4.75 mm sieve. Fine aggregate is material passing the 4.75 mm sieve.

2. Lime - Lime shall be a high-calcium hydrated lime that conforms to the provisions in Section 24-1.02, “Materials,” of the Standard Specifications.

3. Water - Water shall be free from oil and other impurities and shall contain not more than 650 parts per million of chlorides (Cl) and not more than 1300 parts per million of sulfates (SO_4).

PROCEDURE FOR AGGREGATE TREATMENT WITHOUT MARINATION

1. Combine oven-dry samples of the component aggregate in accordance with California Test 304 and allow to cool to room temperature.

   NOTE: The combined aggregate gradation shall include the lime.

2. Weigh-out individual lime batches in the small round tins. (Example: 18 g in each tin provides 1.5% lime content for each 1200 g batch of dry aggregate.)

   NOTE: The Contractor, as part of the mix design process, shall determine the exact proportion of lime. The combined aggregate shall contain not less than 0.8 percent and not more than 1.5 percent lime by mass of dry aggregate. The amount of lime for open graded asphalt concrete may be reduced to between 0.5 percent and 1.0 percent.

3. Place the combined aggregate batch in the mixing bowl.

4. Add 2 percent water by dry weight of aggregate to the combined aggregate.

   NOTE: The moisture content of the aggregate shall be 2 percent by dry weight of the aggregate before mixing with dry lime. Add more moisture, if necessary, to assure complete coating of aggregate particles with lime.

5. Mix the combined aggregate with the water for 2 minutes, then add the desired proportion of hydrated lime and continue mixing for 3 additional minutes, for a total of 5 minutes.

6. After mixing, oven dry the lime-treated aggregate to constant weight at the compaction temperature specified in California Test 304 and proceed with the mix design.

   NOTE: If fine particles or lime residues stick to the pan after drying, use a short bristle brush to remove that material, and recombine it with the rest of the sample.

   NOTE: Once aggregate has been treated with lime, it shall not be treated with lime again.

PROCEDURE FOR AGGREGATE TREATMENT WITH MARINATION

1. Oven-dry samples of the component aggregate in accordance with California Test 304 and allow to cool to room temperature.

   NOTE: The combined aggregate gradation shall include the lime.

2. Add 2 percent water by dry weight of aggregate to the respective samples of component aggregate and mix thoroughly.

NOTE: The moisture content of the aggregate shall be 2 percent by dry weight of the aggregate before mixing with dry lime. If the aggregate readily absorbs the moisture, additional water may be added to assure complete coating of aggregate particles with lime.

3. Determine the mass of lime required to provide the desired content by dry mass of aggregate.

   NOTE: The Contractor, as part of the mix design process, shall determine the exact proportion of lime. The lime content for coarse aggregate shall be 0.4 percent to 1.0 percent by dry mass of coarse aggregate and the lime content for fine aggregate shall be 1.5 percent to 2.0 percent by dry mass of fine aggregate. The combined aggregate shall contain not less than 0.8 percent and not more than 1.5 percent lime by mass of dry aggregate. The amount of lime for open graded asphalt concrete may be reduced to between 0.5 percent and 1.0 percent.

4. Use a trowel or spoon to thoroughly mix the lime with the moisture-conditioned coarse aggregate.

5. Use a trowel or spoon to thoroughly mix the lime with the moisture-conditioned fine aggregate.

6. After the lime-treated aggregates have marinated for at least 24 hours, combine the component samples of aggregate in accordance with California Test 304 and mix the composite blend thoroughly with a trowel or spoon.

   NOTE: Avoid segregation. Break up any lime balls or clods, as necessary.

   NOTE: The lime-treated aggregate shall marinate in the laboratory for not less than 24 hours and not more than 60 days.

7. Place the lime-treated blended aggregate in a pan and oven-dry to constant weight at a temperature of 110 ±5°C and proceed with the mix design in accordance with California Test 304.

   NOTE: If fine particles or lime residues stick to the pan after drying, use a short bristle brush to remove that material, and recombine it with the rest of the sample.

   NOTE: Once aggregate has been treated with lime, it shall not be treated with lime again.

PRECAUTIONS

Hydrated lime is a fine powder. Extra care should be taken when working with lime. Adequate ventilation and the proper safety equipment should be utilized. Avoid contact with the skin and eyes, and avoid breathing contaminated air.